

MATERIAL SAFETY DATA SHEET

SRM Supplier: National Institute of Standards and Technology
Standard Reference Materials Program
Bldg. 202 Rm. 211
Gaithersburg, Maryland 20899

SRM Number: 3159
MSDS Number: 3159
SRM Name: Thorium Standard Solution
Date of Issue: 30 November 2000

MSDS Coordinator: Joylene W.L. Thomas
Phone: (301) 975-6776
ChemTrec: 1-800-424-9300

FAX: (301) 926-4751
E-mail: SRMMSDS@nist.gov

SECTION I. MATERIAL IDENTIFICATION

Material Name: Thorium Spectrometric Standard Solution

Description: SRM 3159 is a single element solution prepared gravimetrically to contain a nominal 10 mg/g of thorium with a nitric acid volume fraction of 10 %.

Other Designations: **Thorium in Nitric Acid** (aqua fortis; hydrogen nitrate; azotic acid; engraver's acid); **Thorium Nitrate*** (thorium tetranitrate; nitric acid, thorium (+4) salt) in **Spectrometric Standard Solution**

Name	Chemical Formula	CAS Registry Number
Nitric Acid	HNO ₃	7697-37-2
Thorium Nitrate	Th(NO ₃) ₄	13823-29-5
Thorium	Th	7440-29-1

DOT Classification: Nitric Acid Solution, UN2031
Limited Quantity Radioactive Material

Manufacturer/Supplier: Available from a number of suppliers

SRM 3159 is a limited quantity radioactive material that is exempt from radioactive labeling requirements under 49CFR section 173.421. The massic activity of SRM 3159 is less than 380 Bq/g.

* The addition of thorium to nitric acid, along with other intermediate chemical reactions, forms thorium nitrate which will precipitate upon evaporation or drying of the sample.

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Components	Nominal Concentration (%)	Exposure Limits and Toxicity Data
Nitric Acid	10	ACGIH TLV-TWA: 2 ppm or 5 mg/m ³
		OSHA TLV-TWA: 2 ppm or 5 mg/m ³
		Human, Oral: LD _{LO} : 430 mg/kg
Thorium Nitrate	2.0	No occupational exposure limits established*
		Rat, Intravenous: LD ₅₀ : 47 600 µg/kg
		Rat, Intraperitoneal: LD ₅₀ : 60 mg/kg
		Mouse, Oral: LD ₅₀ : 1760 mg/kg
Thorium	1	No occupational exposure limits established*

*See U.S. NRC 10 CFR 20 and U.S. OSHA 29 CFR 1910.96.

SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Nitric Acid	Thorium Nitrate	Thorium
Appearance and Odor: a white to slightly yellow liquid that darkens to a brownish color upon aging and exposure to light; an irritating odor	Appearance and Odor: solid, white deliquescent flakes	Appearance and Odor: white, lustrous solid
Relative Molecular Mass: 63.02	Relative Molecular Mass: 480.06	Relative Atomic Mass: 232.04
Density: 1.0543 (10 % nitric acid)	Density: not available	Density (water = 1): 11.7
Water Solubility: soluble	Water Solubility: soluble	Water Solubility: insoluble
Solvent Solubility: decomposes in alcohol	Solvent Solubility: soluble in alcohol	Solvent Solubility: soluble in alkali and hydrochloric acid

NOTE: The physical and chemical data provided is for the pure components. Physical and chemical data on this thorium/nitric acid solution do not exist. The actual behavior of the solution may differ from the individual components.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not available

Method Used: Not available

Autoignition Temperature: Not available

Flammability Limits in Air (Volume %):	UPPER:	Not available
	LOWER:	Not available

Unusual Fire and Explosion Hazards: Although nitric acid does not burn, it is a powerful oxidizing agent that can react with combustible materials to cause fires. Thorium nitrate is a negligible fire hazard; however, as an oxidizer, it may ignite or explode on contact with combustible materials.

Extinguishing Media: Use extinguishing media that is appropriate to the surrounding fire. Use a water spray to dilute nitric acid and to absorb liberated oxides of nitrogen.

Special Fire Procedures: Fire fighters should wear a self-contained breathing apparatus (SCBA) with a full face piece in the pressure demand or positive mode and other protective clothing.

SECTION V. REACTIVITY DATA

Stability: X **Stable** **Unstable**

Conditions to Avoid: Avoid contact with combustible and other incompatible materials.

Incompatibility (Materials to Avoid): Keep nitric acid away from organic materials, plastics, rubber and some forms of coatings. Nitric acid is incompatible with chlorine and metal ferrocyanide. Thorium nitrate may ignite or explode on contact with combustible materials.

See Section IV: *Unusual Fire and Explosion Hazards*

Hazardous Decomposition or Byproducts: Hazardous decomposition of nitric acid and/or thorium nitrate can produce various nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO₂), nitrous oxide (N₂O), as well as nitric acid mist or vapor. Thermal decomposition of thorium may release toxic and/or hazardous gases. Radioactive decomposition products may include gamma radiation.

Hazardous Polymerization: _____ Will Occur X Will Not Occur

SECTION VI. HEALTH HAZARD DATA

Route of Entry: X Inhalation X Skin X Ingestion

Health Hazards (Acute and Chronic): Nitric Acid: Nitric acid may be fatal if inhaled, swallowed, or absorbed through skin. This material causes burns and is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin. Inhalation may be fatal as a result of spasm, inflammation and edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting.

Thorium and Thorium Nitrate: Inhalation of thorium and/or thorium nitrate dust may cause irritation of the nose and throat. Skin contact with the material may cause dermatitis; eye contact may cause conjunctivitis and keratitis. Once deposited into the body, thorium may affect blood formation, disrupt the nervous and reticuloendothelial systems, and causes changes in the lungs and bones. Metabolic chemical reactions may change thorium into thorium oxide, which has been shown to be a carcinogen.

Medical Conditions Generally Aggravated by Exposure: allergies, skin irritations, respiratory, and eye disorders

Listed as a Carcinogen/Potential Carcinogen (Nitric Acid):

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	_____	<u> X </u>
In the International Agency for Research on Cancer (IARC) Monographs	_____	<u> X </u>
By the Occupational Safety and Health Administration (OSHA)	_____	<u> X </u>

NOTE: Thorium oxide has been shown to be a carcinogen.

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with large amounts of water followed by washing the area with soap and water. Watch for chemical irritations and treat them accordingly. Obtain medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Obtain medical assistance.

Inhalation: If inhaled, move the victim to fresh air. If breathing is difficult, give oxygen; if the victim is not breathing, give artificial respiration. Obtain medical assistance if necessary.

Ingestion: If ingestion occurs, wash out mouth with water. **DO NOT** induce vomiting. Obtain medical assistance immediately.

NOTE: (Nitric Acid): Wash affected skin areas with 5 % solution of sodium bicarbonate (NaHCO₃). If ingested, the risk versus the benefit of the passage of a naso-gastric tube is debatable. Activated charcoal is of no value. **DO NOT** give the exposed person bicarbonate to neutralize the material.

TARGET ORGAN(S) OF ATTACK: **Nitric Acid:** skin, teeth, eyes, and upper respiratory tract
 Thorium and Thorium Nitrate: blood, bones, and lungs

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material Is Released or Spilled: Notify safety personnel of spills. Surfaces contaminated with spills should be covered with soda ash or sodium bicarbonate to neutralize the acid. Place the neutralized material into containers suitable for eventual disposal, reclamation, or destruction.

Waste Disposal: Follow all federal, state, and local laws governing disposal.

Handling and Storage: Provide general and local explosion proof ventilation systems to maintain airborne concentrations below the TLV. Provide approved respiratory apparatus for nonroutine or emergency use. Use an approved filter and vapor respirator when the vapor or mist concentrations are high. Wear gloves and chemical safety glasses where contact with the liquid or high vapor concentrations may occur. An eye wash station and washing facilities should be readily available near handling and use areas. Wash exposed skin areas several times a day with soap and warm water. The sample container should be handled by persons qualified to handle both radioactive material and strong acid solutions.

NOTE: Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them.

DO NOT wear contact lenses in the laboratory.

Store this material at room temperature.

SECTION VIII. SOURCE DATA/OTHER COMMENTS

Sources: MDL Information Systems, Inc., MSDS *Nitric Acid*, 13 March 1995.
MDL Information Systems, Inc., MSDS *Thorium*, 08 September 1998.
MDL Information Systems, Inc., MSDS *Thorium Nitrate*, 08 September 1998.
The Merck Index, 11th Ed., 1989.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data on the MSDS. The certified value for this material is given on the NIST Certificate of Analysis.